Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

May 23, 2019

Cardno - Newark, DE

Sample Delivery Group:	L1092766
Samples Received:	04/26/2019
Project Number:	
Description:	
Site:	002 OUTFALL
Report To:	Art Saunders 121 Continental Drive Suite 308 Newark, DE 19713

Entire Report Reviewed By:

Craig Cothron
Project Manager

90015999

TABLE OF CONTENTS

WW-20190424-02-DAY 1 L1092766-01 GW

Collected by: Stephanie Healey
Collected date/time: 04/24/19 12:28
Received date/time: 04/26/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Subcontracted Analyses	WG1273275	1	05/22/19 00:00	05/22/19 00:00	CBM	Minneapolis, MN 55414

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Craig Cothron
Project Manager

Project Narrative

L1092766 -01 contains subout data that is included after the chain of custody.

This data package consists of this signature page, the laboratory review checklist, and the following reportable data as applicable:

R1 - Field chain-of-custody documentation;

R2 - Sample identification cross-reference;

R3 - Test reports (analytical data sheets) for each environmental sample that includes:

a. Items consistent with NELAC Chapter 5,

b. dilution factors,

c. preparation methods,

d. cleanup methods, and

e. if required for the project, tentatively identified compounds (TICs).

R4 - Surrogate recovery data including:

a. Calculated recovery (%R), and

b. The laboratory's surrogate QC limits.

R5 - Test reports/summary forms for blank samples;

R6 - Test reports/summary forms for laboratory control samples (LCSs) including:

a. LCS spiking amounts,

b. Calculated %R for each analyte, and

c. The laboratory's LCS QC limits.

R7 - Test reports for project matrix spike/matrix spike duplicates (MS/MSDs) including:

a. Samples associated with the MS/MSD clearly identified,

b. MS/MSD spiking amounts,

c. Concentration of each MS/MSD analyte measured in the parent and spiked samples,

d. Calculated %Rs and relative percent differences (RPDs), and

e. The laboratory's MS/MSD QC limits

R8 - Laboratory analytical duplicate (if applicable) recovery and precision:

a. The amount of analyte measured in the duplicate,

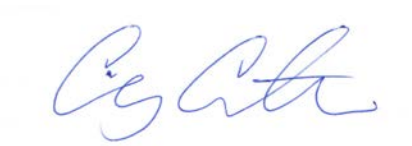
b. The calculated RPD, and

c. The laboratory's QC limits for analytical duplicates.

R9 - List of method quantitation limits (MQLs) and detectability check sample results for each analyte for each method and matrix.

R10 - Other problems or anomalies.

Release Statement: I am responsible for the release of this laboratory data package. This laboratory is NELAC accredited under the Texas Laboratory Accreditation Program for all the methods, analytes, and matrices reported in this data package except as noted in the Exception Reports. The data have been reviewed and are technically compliant with the requirements of the methods used, except where noted by the laboratory in the Exception Reports. By my signature below, I affirm to the best of my knowledge all problems/anomalies observed by the laboratory have been identified in the Laboratory Review Checklist, and no information affecting the quality of the data has been knowingly withheld.



Craig Cothron

Project Manager

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

SDG	Sample Delivery Group.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier | Description

The remainder of this page intentionally left blank, there are no qualifiers applied to this SDG.

Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

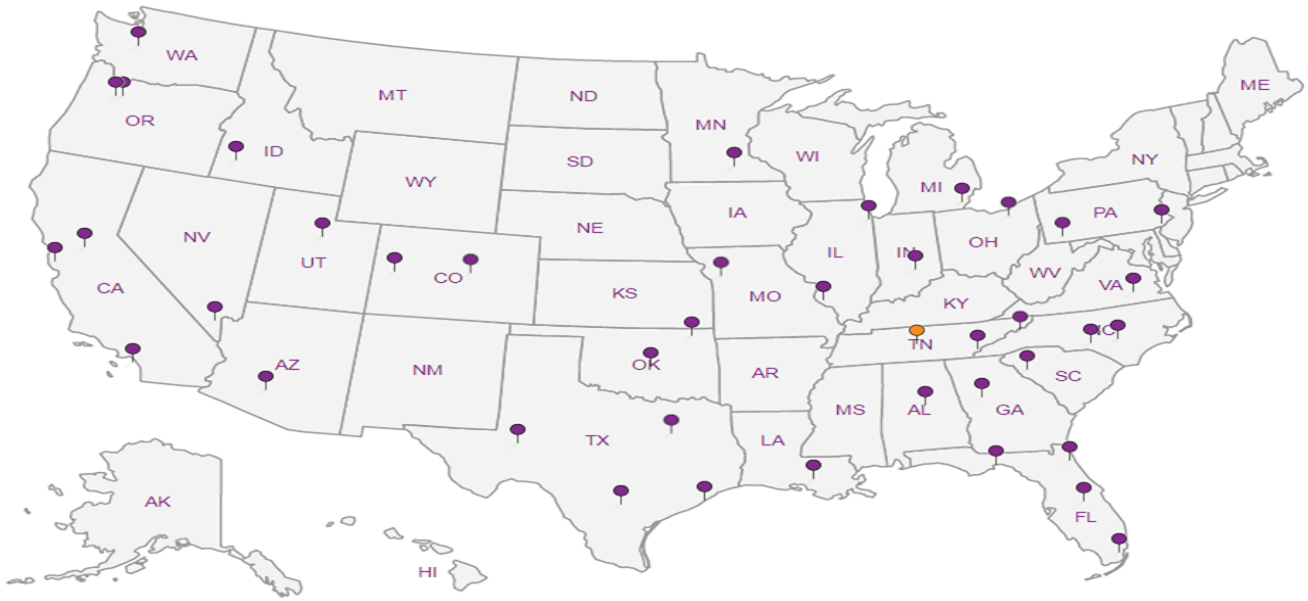
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



Cardno - Newark, DE

121 Continental Drive Suite 308
Newark, DE 19713

Billing Information:
Accounts Payable
121 Continental Drive Suite 308
Newark, DE 19713

Report to: Art Saunders

Email To: Art.Saunders@cardno.com

Project Description:

City/State Collected:

Phone: 610-220-3957
Fax:

Client Project #

Lab Project # CARDNONDE-ITC

Collected by (print): Stephanie Healey

Site/Facility ID # 002 outfall

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
X Two Day ___ 10 Day (Rad Only)
X Three Day

Date Results Needed

Quote #

Pres Chk

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	***CBOD*** 500mlHDPE NoPres 1,2 Dibromoethane 8011 no pres.	***CR6, TDS*** 250mlHDPE-NoPres	8081/8082 100ml Amb-NoPres	8141 100ml Amb NoPres	8270AP9 100ml Amb NoPres	COD, NH3, PT, TKN 250mlHDPE-H2SO4	COLIFERT Microbiological 2,4,5-TP (Silvex) 8151 no pres.	Chloride, pH, CHLORR 250mlHDPE-NoPres	Ethylene Glycol 40mlAmb-NoPres	Extra Volume 1L Amb-No Pres TSS no pres	Remarks	Sample # (lab only)
		GW				36	X	X	X	X	X	X	X	X	X	X		
WW-20190424-002-DAY	Composite	WW	—	4/24/19	1228		X	X	X	X	X	X	X	X	X	X		01
WW-20190424-002-DAY	Grab	WW	—	4/24/19	1228													

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier __ _____

Tracking #

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	4/25/19	16:10	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	4/25/19	20:00	
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: Yes / No
HCL / MeoH
TBR
1

Temp: A3 B4°C 3.0±0=3.0

Bottles Received: 32

Date: 4-26-19 Time: 8:00

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

Sample Receipt Checklist
COC Seal Present/Intact: ✓NP __Y __N
COC Signed/Accurate: ✓Y __N
Bottles arrive intact: ✓Y __N
Correct bottles used: ✓Y __N
Sufficient volume sent: ✓Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N
RAD SCREEN: <0.5 mR/hr

Chain of Custody Page ___ of ___

Pace Analytical®
National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L # 1092766
A154

Acctnum: CARDNONDE
Template: T149278
Prelogin: P704877
TSR: 034 - Craig Cothron
PB:
Shipped Via:

Cardno - Newark, DE
121 Continental Drive Suite 308
Newark, DE 19713

Billing Information:
Accounts Payable
121 Continental Drive Suite 308
Newark, DE 19713

Pres Chk

Report to: Art Saunders
Email To: Art.Saunders@cardno.com

Project Description:
City/State Collected:

Phone: 610-220-3957
Fax:
Client Project #
Lab Project # CARDNONDE-ITC

Collected by (print): Stephanie Healey
Site/Facility ID # 002
P.O. #

Collected by (signature):
Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
X Two Day ___ 10 Day (Rad Only)
X Three Day
Date Results Needed

Quote #

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Extra Volume 40mlAmb-NoPres 1dg4 Oil & Grease	Metals 250mlHDPE-HNO3	OGHEX 1L-Cl-Add HCl no pres 8270/1613 Dioxins/Furans	PFAS/PFOS- Sub 1L-HDPE-NoPres	SV8151 1L-Amb-No Pres 8260	SV8290 1L-Amb-NoPres	Sulfide 125mlAmb-S-NaOH+ZnAc	TOC 250mlAmb-HCl	TSS 1L-HDPE-NoPres	Total Cyanide 250mlHDPEAmb-NaOH	Remarks	Sample # (lab only)
		GW				36	X	X	X	X	X	X	X	X	X	X		
WW-20190424-002-DAY1	Grab	WW	—	4/24/19	1228		X									X		01
WW-20190424-002-DAY1	Comp	WW	—	4/24/19	1228			X	X	X	X		X	X				

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier __ _____
Tracking #

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RADSCREEN: <0.5 mR/hr

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR
	2/25/19	16:10	4/25/19 16:10	1
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: A3 °C 3.0±0=3.0 / Bottles Received: 32
	4/25/19	20:00		
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 4-26-19 / Time: 8:00

If preservation required by Login: Date/Time
Hold:
Condition: NCF / OK

Chain of Custody Page ___ of ___

Pace Analytical®
National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# 192761
Table #
Acctnum: CARDNONDE
Template: T149278
Prelogin: P704877
TSR: 034 - Craig Cothron
PB:
Shipped Via:

Pace Analytical™
www.pacelabs.com

Pace Analytical Services, LLC.
1700 Elm Street
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6444

Report Prepared for:

Benita Miller
Pace Analytical National
12065 Lebanon Road
Mount Juliet TN 37122

REPORT OF LABORATORY ANALYSIS FOR PCDD/PCDF

Report Information:

Pace Project #: 10473163
Sample Receipt Date: 05/02/2019
Client Project #: L1092766: Cardno
Client Sub PO #: S26326
State Cert #: T104704192

Invoicing & Reporting Options:

The report provided has been invoiced as a Level 3 PCDD/PCDF Report. If an upgrade of this report package is requested, an additional charge may be applied.

Please review the attached invoice for accuracy and forward any questions to Nathan Boberg, your Pace Project Manager.

This report has been reviewed by:

May 10, 2019

Nathan Boberg, Project Manager
612-360-0728
(612) 607-6444 (fax)
nathan.boberg@pacelabs.com

Report Prepared Date:
May 10, 2019

Report of Laboratory Analysis

Pace Analytical Services, LLC.
1700 Elm Street
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6444

DISCUSSION

This report presents the results from the analysis performed on one sample submitted by a representative of Pace Analytical National. The sample was analyzed for the presence or absence of polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs) using USEPA Method 1613B. The reporting limits were based on signal-to-noise measurements. Estimated Maximum Possible Concentration (EMPC) values were treated as positives in the toxic equivalence calculations.

The recoveries of the isotopically-labeled PCDD/PCDF internal standards in the sample extract ranged from 61-96%. All of the labeled standard recoveries obtained for this project were within the target ranges specified in Method 1613B. Also, since the quantification of the native 2,3,7,8-substituted congeners was based on isotope dilution, the data were automatically corrected for recovery and accurate values were obtained.

Values were flagged "I" where incorrect isotope ratios were obtained. Concentrations below the calibration range were flagged "J" and should be regarded as estimates.

A laboratory method blank was prepared and analyzed with the sample batch as part of our routine quality control procedures. The results show the blank to contain a trace level of OCDD. This level was below the calibration range of the method. Also, OCDD was not detected in the field sample.

Laboratory spike samples were also prepared with the sample batch using clean reference matrix that had been fortified with native standard materials. The results show that the spiked native compounds were recovered at 96-124% with relative percent differences of 2.5-16.2%. These results were within the target ranges for the method. Matrix spikes were not prepared with the sample batch.

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Minnesota Laboratory Certifications

Authority	Certificate #	Authority	Certificate #
A2LA	2926.01	Minnesota - Pet	1240
Alabama	40770	Mississippi	MN00064
Alaska - DW	MN00064	Missouri - DW	10100
Alaska - UST	17-009	Montana	CERT0092
Arizona	AZ0014	Nebraska	NE-OS-18-06
Arkansas - DW	MN00064	Nevada	MN00064
Arkansas - WW	88-0680	New Hampshire	2081
CNMI Saipan	MP0003	New Jersey (NE	MN002
California	2929	New York	11647
Colorado	MN00064	North Carolina	27700
Connecticut	PH-0256	North Carolina -	27700
EPA Region 8+	via MN 027-053	North Carolina -	530
Florida (NELAP	E87605	North Dakota	R-036
Georgia	959	Ohio - DW	41244
Guam	17-001r	Ohio - VAP	CL101
Hawaii	MN00064	Oklahoma	9507
Idaho	MN00064	Oregon - Primar	MN300001
Illinois	200011	Oregon - Secon	MN200001
Indiana	C-MN-01	Pennsylvania	68-00563
Iowa	368	Puerto Rico	MN00064
Kansas	E-10167	South Carolina	74003
Kentucky - DW	90062	South Dakota	NA
Kentucky - WW	90062	Tennessee	TN02818
Louisiana - DE	03086	Texas	T104704192
Louisiana - DW	MN00064	Utah (NELAP)	MN00064
Maine	MN00064	Virginia	460163
Maryland	322	Washington	C486
Massachusetts	M-MN064	West Virginia -	382
Michigan	9909	West Virginia -	9952C
Minnesota	027-053-137	Wisconsin	999407970
Minnesota - De	via MN 027-053	Wyoming - UST	2926.01

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Reporting Flags

A = Reporting Limit based on signal to noise

B = Less than 10x higher than method blank level

C = Result obtained from confirmation analysis

D = Result obtained from analysis of diluted sample

E = Exceeds calibration range

I = Interferencepresent

J = Estimated value

L = Suppressive interference, analyte may be biased low

Nn = Value obtained from additional analysis

P = PCDEInterference

R = Recovery outside target range

S = Peak saturated

U = Analyte not detected

V = Result verified by confirmation analysis

X = %D Exceeds limits

Y = Calculated using average of daily RFs

* = SeeDiscussion

REPORT OF LABORATORY ANALYSIS

Appendix A

Sample Management

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Sample ID Cross Reference

Client Sample ID	Pace Sample ID	Date Received	Sample Type
WW-20190424-02-DAY 1	10473163001	05/02/2019	Water

REPORT OF LABORATORY ANALYSIS

CHAIN-OF-CUSTODY / Analytical Request D

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields mus

WO# : 10473163

10473163

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	Pace Analytical National	Report To:	Pace Analytical National Subout Team	Attention:	Art Saunders
Address:	12065 Lebanon Road	Copy To:		Company Name:	
	Mount Juliet, TN 37122			Address:	
Email:	SuboutTeam@pacenational.com	Purchase Order #:	L1092766	Pace Quote:	
Phone:	(615)773-9756 Fax: (615)758-5859	Project Name:	N/A	Pace Project Manager:	Nathan Boberg
Requested Due Date:	10-May	Project #:	N/A	Pace Profile #:	38076

Regulatory Agency

State / Location: DE

Requested Analysis Filtered (Y/N)

SAMPLE ID
One Character per box.
(A-Z, 0-9 / , -)
Sample Ids must be unique

MATRIX	CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Other	OT
Tissue	TS

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	PFAS/PFOS 537 and Dioxin/Furans 1613	Residual Chlorine (Y/N)	
1	WW-20190424-02-DAY 1	WT				24-Apr	12:28		1	1									X		001
2																					
3																					
9																					
10																					
11																					
12																					

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	Benita Miller BM	1-May	13:50		5/2/19	950	4.0	1	∝	Y
Pace Analytical National Batch: WG1273275										
Pace Analytical National SDGs: L1092766										
Location: Minneapolis, MN 55414										

This eCOC is for the DIOXINS that were not shipped earlier.

SAMPLER NAME AND SIGNATURE					
PRINT Name of SAMPLER:			TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
SIGNATURE of SAMPLER:	DATE Signed:					

Pace Analytical	Document Name: **Sample Condition Upon Receipt Form**	Document Revised: 05Apr2019 Page 1 of 1
	Document No.: **F-MN-L-213-rev.27**	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: Pace National

Project #: **WO#: 10473163**

PM: NB3 **Due Date: 05/16/19**

CLIENT: ESC_TN

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Pace ☐ SpeeDee ☐ Commercial **See Exception** ☐

Tracking Number: 4876 1095 6020

Custody Seal on Cooler/Box Present? ☐ Yes ☒ No **Seals Intact?** ☐ Yes ☒ No **Biological Tissue Frozen?** ☐ Yes ☐ No ☒ N/A

Packing Material: ☒ Bubble Wrap ☒ Bubble Bags ☐ None ☐ Other: _____ **Temp Blank?** ☒ Yes ☐ No

Thermometer: ☐ T1(0461) ☐ T2(1336) ☒ T3(0459) ☐ T4(0254) ☐ T5(0048) **Type of Ice:** ☒ Wet ☐ Blue ☐ None ☐ Dry ☐ Melted

Note: Each West Virginia Sample must have temp taken (no temp blanks)

Temp should be above freezing to 6°C **Cooler Temp Read w/temp blank:** 4.0 °C **Average Corrected Temp (no temp blank only):** ____ °C **See Exceptions** ☐

Correction Factor: +0 **Cooler Temp Corrected w/temp blank:** 4.0 °C

USDA Regulated Soil: (☒ N/A, water sample/Other: _____) **Date/Initials of Person Examining Contents:** BV 5/2/19

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA. MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐ Yes ☐ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☐ No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

				COMMENTS:
Chain of Custody Present and Filled Out?	☒ Yes	☐ No		1.
Chain of Custody Relinquished?	☒ Yes	☐ No		2.
Sampler Name and/or Signature on COC?	☐ Yes	☒ No	☐ N/A	3.
Samples Arrived within Hold Time?	☒ Yes	☐ No		4.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☒ No		5. ☐ Fecal Coliform ☐ HPC ☐ Total Coliform/E coli ☐ BOD/cBOD ☐ Hex Chrome ☐ Turbidity ☐ Nitrate ☐ Nitrite ☐ Orthophos ☐ Other _____
Rush Turn Around Time Requested?	☐ Yes	☒ No		6.
Sufficient Volume?	☒ Yes	☐ No		7.
Correct Containers Used?	☒ Yes	☐ No		8.
-Pace Containers Used?	☐ Yes	☒ No		
Containers Intact?	☒ Yes	☐ No		9.
Field Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☒ N/A	10. Is sediment visible in the dissolved container? ☐ Yes ☐ No
Is sufficient information available to reconcile the samples to the COC?	☒ Yes	☐ No		11. **If no, write ID/ Date/Time on Container Below:** **See Exception** ☐
Matrix: ☒ Water ☐ Soil ☐ Oil ☐ Other _____				
All containers needing acid/base preservation have been checked?	☐ Yes	☐ No	☒ N/A	12. Sample #
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)	☐ Yes	☐ No	☒ N/A	☐ NaOH ☐ HNO_3 ☐ H_2SO_4 ☐ Zinc Acetate
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin/PFAS	☐ Yes	☐ No	☒ N/A	Positive for Res. Chlorine? ☐ Yes ☐ No **pH Paper Lot#** **See Exception** ☐
				Res. Chlorine | 0-6 Roll | 0-6 Strip | 0-14 Strip
Headspace in VOA Vials (greater than 6mm)?	☐ Yes	☐ No	☒ N/A	13. **See Exception** ☐
Trip Blank Present?	☐ Yes	☐ No	☒ N/A	14.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☒ N/A	Pace Trip Blank Lot # (if purchased): NA

CLIENT NOTIFICATION/RESOLUTION **Field Data Required?** ☐ Yes ☐ No

Person Contacted: _____ Date/Time: _____

Comments/Resolution: This workorder references method 1613- PCDD/PCDF only.

Project Manager Review: Lathan Boberg **Date:** 5/6/19

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers).

Labeled by: BV

Appendix B

Sample Analysis Summary

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Sample Analysis Results

Client - Pace Analytical National

Client's Sample ID	WW-20190424-02-DAY 1		
Lab Sample ID	10473163001		
Filename	F190509B_05		
Injected By	SMT		
Total Amount Extracted	1040 mL	Matrix	Water
% Moisture	NA	Dilution	NA
Dry Weight Extracted	NA	Collected	04/24/2019 12:28
ICAL ID	F190508	Received	05/02/2019 09:50
CCal Filename(s)	F190509A_16	Extracted	05/07/2019 10:05
Method Blank ID	BLANK-70341	Analyzed	05/09/2019 19:10

Native Isomers	Conc pg/L	EMPC pg/L	EDL pg/L	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	2.5	2,3,7,8-TCDF-13C	2.00	81
Total TCDF	ND	-----	2.5	2,3,7,8-TCDD-13C	2.00	81
				1,2,3,7,8-PeCDF-13C	2.00	87
2,3,7,8-TCDD	ND	-----	1.9	2,3,4,7,8-PeCDF-13C	2.00	85
Total TCDD	ND	-----	1.9	1,2,3,7,8-PeCDD-13C	2.00	96
				1,2,3,4,7,8-HxCDF-13C	2.00	76
1,2,3,7,8-PeCDF	ND	-----	2.9	1,2,3,6,7,8-HxCDF-13C	2.00	79
2,3,4,7,8-PeCDF	ND	-----	1.2	2,3,4,6,7,8-HxCDF-13C	2.00	79
Total PeCDF	ND	-----	2.1	1,2,3,7,8,9-HxCDF-13C	2.00	81
				1,2,3,4,7,8-HxCDD-13C	2.00	75
1,2,3,7,8-PeCDD	ND	-----	2.8	1,2,3,6,7,8-HxCDD-13C	2.00	73
Total PeCDD	ND	-----	2.8	1,2,3,4,6,7,8-HpCDF-13C	2.00	70
				1,2,3,4,7,8,9-HpCDF-13C	2.00	71
1,2,3,4,7,8-HxCDF	ND	-----	0.73	1,2,3,4,6,7,8-HpCDD-13C	2.00	78
1,2,3,6,7,8-HxCDF	ND	-----	0.87	OCDD-13C	4.00	61
2,3,4,6,7,8-HxCDF	ND	-----	0.80			
1,2,3,7,8,9-HxCDF	ND	-----	1.0	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.86	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	1.5	2,3,7,8-TCDD-37Cl4	0.20	92
1,2,3,6,7,8-HxCDD	ND	-----	1.7			
1,2,3,7,8,9-HxCDD	ND	-----	1.7			
Total HxCDD	ND	-----	1.6			
1,2,3,4,6,7,8-HpCDF	ND	-----	1.1	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	1.6	Equivalence: 0.00 pg/L		
Total HpCDF	ND	-----	1.3	(Lower-bound - Using 2005 WHO Factors)		
1,2,3,4,6,7,8-HpCDD	ND	-----	1.3			
Total HpCDD	ND	-----	1.3			
OCDF	ND	-----	4.6			
OCDD	ND	-----	2.0			

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
EDL = Estimated Detection Limit

ND = Not Detected
NA = Not Applicable
NC = Not Calculated

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

2,3,7,8-TCDD Toxic Equivalency (TEQ) Calculations

Pace Analytical National

Client's Sample ID	WW-20190424-02-DAY 1		
Lab Sample ID	10473163001		
Filename	F190509B_05		
Injected By	SMT		
Total Amount Extracted	1040 mL	Matrix	Water
% Moisture	NA	Dilution	NA
Dry Weight Extracted	NA	Collected	04/24/2019 12:28
ICAL ID	F190508	Received	05/02/2019 09:50
CCal Filename(s)	F190509A_16	Extracted	05/07/2019 10:05
Method Blank ID	BLANK-70341	Analyzed	05/09/2019 19:10

Parameter	Conc pg/L	RL pg/L	WHO2005	LB	MB	UB
2,3,7,8-TCDF	ND	2.5	0.10000	0.0000	0.1249	0.2498
Total TCDF	ND	2.5	0.00000	0.0000	0.0000	0.0000
2,3,7,8-TCDD	ND	1.9	1.00000	0.0000	0.9327	1.8653
Total TCDD	ND	1.9	0.00000	0.0000	0.0000	0.0000
1,2,3,7,8-PeCDF	ND	2.9	0.03000	0.0000	0.0437	0.0875
2,3,4,7,8-PeCDF	ND	1.2	0.30000	0.0000	0.1790	0.3580
Total PeCDF	ND	2.1	0.00000	0.0000	0.0000	0.0000
1,2,3,7,8-PeCDD	ND	2.8	1.00000	0.0000	1.4111	2.8223
Total PeCDD	ND	2.8	0.00000	0.0000	0.0000	0.0000
1,2,3,4,7,8-HxCDF	ND	0.73	0.10000	0.0000	0.0363	0.0727
1,2,3,6,7,8-HxCDF	ND	0.87	0.10000	0.0000	0.0437	0.0873
2,3,4,6,7,8-HxCDF	ND	0.80	0.10000	0.0000	0.0400	0.0800
1,2,3,7,8,9-HxCDF	ND	1.0	0.10000	0.0000	0.0516	0.1033
Total HxCDF	ND	0.86	0.00000	0.0000	0.0000	0.0000
1,2,3,4,7,8-HxCDD	ND	1.5	0.10000	0.0000	0.0767	0.1534
1,2,3,6,7,8-HxCDD	ND	1.7	0.10000	0.0000	0.0831	0.1663
1,2,3,7,8,9-HxCDD	ND	1.7	0.10000	0.0000	0.0840	0.1680
Total HxCDD	ND	1.6	0.00000	0.0000	0.0000	0.0000
1,2,3,4,6,7,8-HpCDF	ND	1.1	0.01000	0.0000	0.0057	0.0113
1,2,3,4,7,8,9-HpCDF	ND	1.6	0.01000	0.0000	0.0078	0.0156
Total HpCDF	ND	1.3	0.00000	0.0000	0.0000	0.0000
1,2,3,4,6,7,8-HpCDD	ND	1.3	0.01000	0.0000	0.0065	0.0130
Total HpCDD	ND	1.3	0.00000	0.0000	0.0000	0.0000
OCDF	ND	4.6	0.00030	0.0000	0.0007	0.0014
OCDD	ND	2.0	0.00030	0.0000	0.0003	0.0006
				0.00 pg/L	**3.1 pg/L**	**6.3 pg/L**

Final values are valid to only 2 significant figures
TEQs for Totals classes include contributions from non 2,3,7,8 isomers only
LB = Lower Bound, Where "ND", TEQ Conc = 0
MB = Medium Bound, Where "ND", TEQ Conc = (LOD/2) * (TEF Factor)
UB = Upper Bound, Where "ND", TEQ Conc = LOD * (TEF Factor)
RL = Reporting Limit

REPORT OF LABORATORY ANALYSIS

Appendix C

QC and Calibration Results Summary

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Blank Analysis Results

Lab Sample Name	DFBLKTF		
Lab Sample ID	BLANK-70341	Matrix	Water
Filename	F190509B_03	Dilution	NA
Total Amount Extracted	970 mL	Extracted	05/07/2019 10:05
ICAL ID	F190508	Analyzed	05/09/2019 17:46
CCal Filename(s)	F190509A_16	Injected By	SMT

Native Isomers	Conc pg/L	EMPC pg/L	EDL pg/L	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.75	2,3,7,8-TCDF-13C	2.00	75
Total TCDF	ND	-----	0.75	2,3,7,8-TCDD-13C	2.00	76
				1,2,3,7,8-PeCDF-13C	2.00	78
2,3,7,8-TCDD	ND	-----	0.91	2,3,4,7,8-PeCDF-13C	2.00	78
Total TCDD	ND	-----	0.91	1,2,3,7,8-PeCDD-13C	2.00	88
				1,2,3,4,7,8-HxCDF-13C	2.00	69
1,2,3,7,8-PeCDF	ND	-----	1.1	1,2,3,6,7,8-HxCDF-13C	2.00	74
2,3,4,7,8-PeCDF	ND	-----	0.73	2,3,4,6,7,8-HxCDF-13C	2.00	76
Total PeCDF	ND	-----	0.90	1,2,3,7,8,9-HxCDF-13C	2.00	75
				1,2,3,4,7,8-HxCDD-13C	2.00	71
1,2,3,7,8-PeCDD	ND	-----	1.4	1,2,3,6,7,8-HxCDD-13C	2.00	67
Total PeCDD	ND	-----	1.4	1,2,3,4,6,7,8-HpCDF-13C	2.00	65
				1,2,3,4,7,8,9-HpCDF-13C	2.00	70
1,2,3,4,7,8-HxCDF	ND	-----	0.34	1,2,3,4,6,7,8-HpCDD-13C	2.00	74
1,2,3,6,7,8-HxCDF	ND	-----	0.41	OCDD-13C	4.00	59
2,3,4,6,7,8-HxCDF	ND	-----	0.31			
1,2,3,7,8,9-HxCDF	ND	-----	0.38	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.36	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.60	2,3,7,8-TCDD-37Cl4	0.20	100
1,2,3,6,7,8-HxCDD	ND	-----	0.93			
1,2,3,7,8,9-HxCDD	ND	-----	0.66			
Total HxCDD	ND	-----	0.73			
1,2,3,4,6,7,8-HpCDF	ND	-----	0.63	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.54	Equivalence: 0.012 pg/L		
Total HpCDF	ND	-----	0.59	(Lower-bound - Using 2005 WHO Factors)		
1,2,3,4,6,7,8-HpCDD	-----	1.1	0.95 IJ			
Total HpCDD	ND	-----	0.95			
OCDF	ND	-----	1.7			
OCDD	5.4	-----	1.9 J			

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
EDL = Estimated Detection Limit

J = Estimated value
I = Interference present

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

2,3,7,8-TCDD Toxic Equivalency (TEQ) Calculations

Pace Analytical National

Client's Sample ID	DFBLKTF		
Lab Sample ID	BLANK-70341		
Filename	F190509B_03		
Injected By	SMT		
Total Amount Extracted	970 mL	Matrix	Water
% Moisture	NA	Dilution	NA
Dry Weight Extracted	NA	Collected	05/06/2019 13:04
ICAL ID	F190508	Received	05/06/2019 13:04
CCal Filename(s)	F190509A_16	Extracted	05/07/2019 10:05
Method Blank ID		Analyzed	05/09/2019 17:46

Parameter	Conc pg/L	RL pg/L	WHO2005	LB	MB	UB
2,3,7,8-TCDF	ND	0.75	0.10000	0.0000	0.0376	0.0753
Total TCDF	ND	0.75	0.00000	0.0000	0.0000	0.0000
2,3,7,8-TCDD	ND	0.91	1.00000	0.0000	0.4543	0.9085
Total TCDD	ND	0.91	0.00000	0.0000	0.0000	0.0000
1,2,3,7,8-PeCDF	ND	1.1	0.03000	0.0000	0.0159	0.0318
2,3,4,7,8-PeCDF	ND	0.73	0.30000	0.0000	0.1101	0.2201
Total PeCDF	ND	0.90	0.00000	0.0000	0.0000	0.0000
1,2,3,7,8-PeCDD	ND	1.4	1.00000	0.0000	0.6943	1.3886
Total PeCDD	ND	1.4	0.00000	0.0000	0.0000	0.0000
1,2,3,4,7,8-HxCDF	ND	0.34	0.10000	0.0000	0.0172	0.0344
1,2,3,6,7,8-HxCDF	ND	0.41	0.10000	0.0000	0.0206	0.0413
2,3,4,6,7,8-HxCDF	ND	0.31	0.10000	0.0000	0.0156	0.0312
1,2,3,7,8,9-HxCDF	ND	0.38	0.10000	0.0000	0.0189	0.0377
Total HxCDF	ND	0.36	0.00000	0.0000	0.0000	0.0000
1,2,3,4,7,8-HxCDD	ND	0.60	0.10000	0.0000	0.0301	0.0601
1,2,3,6,7,8-HxCDD	ND	0.93	0.10000	0.0000	0.0466	0.0932
1,2,3,7,8,9-HxCDD	ND	0.66	0.10000	0.0000	0.0331	0.0662
Total HxCDD	ND	0.73	0.00000	0.0000	0.0000	0.0000
1,2,3,4,6,7,8-HpCDF	ND	0.63	0.01000	0.0000	0.0032	0.0063
1,2,3,4,7,8,9-HpCDF	ND	0.54	0.01000	0.0000	0.0027	0.0054
Total HpCDF	ND	0.59	0.00000	0.0000	0.0000	0.0000
1,2,3,4,6,7,8-HpCDD	ND	0.95	0.01000	0.0107	0.0107	0.0107
Total HpCDD	ND	0.95	0.00000	0.0000	0.0000	0.0000
OCDF	ND	1.7	0.00030	0.0000	0.0003	0.0005
OCDD	5.4	1.9	0.00030	0.0016	0.0016	0.0016
				0.012 pg/L	**1.5 pg/L**	**3.0 pg/L**

Final values are valid to only 2 significant figures
TEQs for Totals classes include contributions from non 2,3,7,8 isomers only
LB = Lower Bound, Where "ND", TEQ Conc = 0
MB = Medium Bound, Where "ND", TEQ Conc = (LOD/2) * (TEF Factor)
UB = Upper Bound, Where "ND", TEQ Conc = LOD * (TEF Factor)
RL = Reporting Limit

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Laboratory Control Spike Results

Lab Sample ID	LCS-70342		
Filename	F190509A_15	Matrix	Water
Total Amount Extracted	937 mL	Dilution	NA
ICAL ID	F190508	Extracted	05/07/2019 10:05
CCal Filename	F190508B_19	Analyzed	05/09/2019 14:58
Method Blank ID	BLANK-70341	Injected By	SMT

Compound	Cs	Cr	Lower Limit	Upper Limit	% Rec.
2,3,7,8-TCDF	10	11	7.5	15.8	106
2,3,7,8-TCDD	10	12	6.7	15.8	118
1,2,3,7,8-PeCDF	50	57	40.0	67.0	114
2,3,4,7,8-PeCDF	50	59	34.0	80.0	118
1,2,3,7,8-PeCDD	50	53	35.0	71.0	105
1,2,3,4,7,8-HxCDF	50	61	36.0	67.0	122
1,2,3,6,7,8-HxCDF	50	56	42.0	65.0	111
2,3,4,6,7,8-HxCDF	50	55	35.0	78.0	111
1,2,3,7,8,9-HxCDF	50	56	39.0	65.0	112
1,2,3,4,7,8-HxCDD	50	62	35.0	82.0	124
1,2,3,6,7,8-HxCDD	50	61	38.0	67.0	121
1,2,3,7,8,9-HxCDD	50	61	32.0	81.0	122
1,2,3,4,6,7,8-HpCDF	50	59	41.0	61.0	118
1,2,3,4,7,8,9-HpCDF	50	55	39.0	69.0	109
1,2,3,4,6,7,8-HpCDD	50	53	35.0	70.0	106
OCDF	100	110	63.0	170.0	113
OCDD	100	120	78.0	144.0	120
2,3,7,8-TCDD-37Cl4	10	9.5	3.1	19.1	95
2,3,7,8-TCDF-13C	100	79	22.0	152.0	79
2,3,7,8-TCDD-13C	100	80	20.0	175.0	80
1,2,3,7,8-PeCDF-13C	100	79	21.0	192.0	79
2,3,4,7,8-PeCDF-13C	100	80	13.0	328.0	80
1,2,3,7,8-PeCDD-13C	100	90	21.0	227.0	90
1,2,3,4,7,8-HxCDF-13C	100	73	19.0	202.0	73
1,2,3,6,7,8-HxCDF-13C	100	79	21.0	159.0	79
2,3,4,6,7,8-HxCDF-13C	100	81	22.0	176.0	81
1,2,3,7,8,9-HxCDF-13C	100	80	17.0	205.0	80
1,2,3,4,7,8-HxCDD-13C	100	74	21.0	193.0	74
1,2,3,6,7,8-HxCDD-13C	100	73	25.0	163.0	73
1,2,3,4,6,7,8-HpCDF-13C	100	72	21.0	158.0	72
1,2,3,4,7,8,9-HpCDF-13C	100	73	20.0	186.0	73
1,2,3,4,6,7,8-HpCDD-13C	100	79	26.0	166.0	79
OCDD-13C	200	120	26.0	397.0	61

Cs = Concentration Spiked (ng/mL)
Cr = Concentration Recovered (ng/mL)
Rec. = Recovery (Expressed as Percent)
Control Limit Reference: Method 1613, Table 6, 10/94 Revision
R = Recovery outside of control limits
Nn = Value obtained from additional analysis
* = See Discussion

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 1613B Laboratory Control Spike Results

Lab Sample ID	LCSD-70343		
Filename	F190509B_01	Matrix	Water
Total Amount Extracted	927 mL	Dilution	NA
ICAL ID	F190508	Extracted	05/07/2019 10:05
CCal Filename	F190509A_16	Analyzed	05/09/2019 16:22
Method Blank ID	BLANK-70341	Injected By	SMT

Compound	Cs	Cr	Lower Limit	Upper Limit	% Rec.
2,3,7,8-TCDF	10	9.6	7.5	15.8	96
2,3,7,8-TCDD	10	12	6.7	15.8	115
1,2,3,7,8-PeCDF	50	54	40.0	67.0	107
2,3,4,7,8-PeCDF	50	54	34.0	80.0	108
1,2,3,7,8-PeCDD	50	50	35.0	71.0	100
1,2,3,4,7,8-HxCDF	50	56	36.0	67.0	113
1,2,3,6,7,8-HxCDF	50	54	42.0	65.0	108
2,3,4,6,7,8-HxCDF	50	51	35.0	78.0	102
1,2,3,7,8,9-HxCDF	50	53	39.0	65.0	106
1,2,3,4,7,8-HxCDD	50	54	35.0	82.0	108
1,2,3,6,7,8-HxCDD	50	59	38.0	67.0	118
1,2,3,7,8,9-HxCDD	50	58	32.0	81.0	116
1,2,3,4,6,7,8-HpCDF	50	55	41.0	61.0	110
1,2,3,4,7,8,9-HpCDF	50	51	39.0	69.0	103
1,2,3,4,6,7,8-HpCDD	50	50	35.0	70.0	101
OCDF	100	110	63.0	170.0	107
OCDD	100	100	78.0	144.0	102
2,3,7,8-TCDD-37Cl4	10	9.3	3.1	19.1	93
2,3,7,8-TCDF-13C	100	77	22.0	152.0	77
2,3,7,8-TCDD-13C	100	76	20.0	175.0	76
1,2,3,7,8-PeCDF-13C	100	76	21.0	192.0	76
2,3,4,7,8-PeCDF-13C	100	77	13.0	328.0	77
1,2,3,7,8-PeCDD-13C	100	85	21.0	227.0	85
1,2,3,4,7,8-HxCDF-13C	100	66	19.0	202.0	66
1,2,3,6,7,8-HxCDF-13C	100	70	21.0	159.0	70
2,3,4,6,7,8-HxCDF-13C	100	74	22.0	176.0	74
1,2,3,7,8,9-HxCDF-13C	100	72	17.0	205.0	72
1,2,3,4,7,8-HxCDD-13C	100	69	21.0	193.0	69
1,2,3,6,7,8-HxCDD-13C	100	64	25.0	163.0	64
1,2,3,4,6,7,8-HpCDF-13C	100	64	21.0	158.0	64
1,2,3,4,7,8,9-HpCDF-13C	100	66	20.0	186.0	66
1,2,3,4,6,7,8-HpCDD-13C	100	72	26.0	166.0	72
OCDD-13C	200	110	26.0	397.0	56

Cs = Concentration Spiked (ng/mL)
Cr = Concentration Recovered (ng/mL)
Rec. = Recovery (Expressed as Percent)
Control Limit Reference: Method 1613, Table 6, 10/94 Revision
R = Recovery outside of control limits
Nn = Value obtained from additional analysis
* = See Discussion

REPORT OF LABORATORY ANALYSIS

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Method 1613B

Spike Recovery Relative Percent Difference (RPD) Results

Client	Pace Analytical National		
Spike 1 ID	LCS-70342	Spike 2 ID	LCSD-70343
Spike 1 Filename	F190509A_15	Spike 2 Filename	F190509B_01

Compound	Spike 1 %REC	Spike 2 %REC	%RPD
2,3,7,8-TCDF	106	96	9.9
2,3,7,8-TCDD	118	115	2.6
1,2,3,7,8-PeCDF	114	107	6.3
2,3,4,7,8-PeCDF	118	108	8.8
1,2,3,7,8-PeCDD	105	100	4.9
1,2,3,4,7,8-HxCDF	122	113	7.7
1,2,3,6,7,8-HxCDF	111	108	2.7
2,3,4,6,7,8-HxCDF	111	102	8.5
1,2,3,7,8,9-HxCDF	112	106	5.5
1,2,3,4,7,8-HxCDD	124	108	13.8
1,2,3,6,7,8-HxCDD	121	118	2.5
1,2,3,7,8,9-HxCDD	122	116	5.0
1,2,3,4,6,7,8-HpCDF	118	110	7.0
1,2,3,4,7,8,9-HpCDF	109	103	5.7
1,2,3,4,6,7,8-HpCDD	106	101	4.8
OCDF	113	107	5.5
OCDD	120	102	16.2

%REC = Percent Recovered
RPD = The difference between the two values divided by the mean value

REPORT OF LABORATORY ANALYSIS

Method 1613B
Initial Calibration (ICAL) - Response Factor Summary

ICAL ID	**F190508**	Data Files:		Time	Injected
Calibration Date	05/08/2019	CS-1	F190508A_04	11:43	SMT
Instrument	10MSHR05 (F)	CS-2	F190508A_03	11:02	SMT
Column Phase	ZB5-MS 0.25mm	CS-3	F190508A_02	10:00	SMT
Column ID No.	ZB5-MS-629919	CS-4	F190508A_06	13:46	SMT
		CS-5	F190508A_05	13:05	SMT

Isomer	CS-1	CS-2	CS-3	CS-4	CS-5	Ave RF	%RSD
2,3,7,8-TCDF	0.8288	0.8067	0.8548	0.9247	0.9310	0.8692	6.47
2,3,7,8-TCDD	0.7258	0.7466	0.9053	0.8472	0.8884	0.8226	9.97
1,2,3,7,8-PeCDF	0.7848	0.8155	0.9265	0.9294	0.9605	0.8833	8.81
2,3,4,7,8-PeCDF	0.9141	0.9583	1.0049	1.0616	1.0418	0.9961	6.07
1,2,3,7,8-PeCDD	0.7512	0.7742	0.8516	0.8895	0.8836	0.8300	7.67
1,2,3,4,7,8-HxCDF	1.0236	1.1127	1.1608	1.1726	1.2089	1.1357	6.29
1,2,3,6,7,8-HxCDF	1.0014	1.0246	1.1187	1.1501	1.1270	1.0844	6.15
2,3,4,6,7,8-HxCDF	1.0507	1.1409	1.1858	1.2495	1.2346	1.1723	6.85
1,2,3,7,8,9-HxCDF	0.9781	1.0316	1.0873	1.1379	1.1166	1.0703	6.09
1,2,3,4,7,8-HxCDD	0.8555	0.8687	0.9233	0.9402	0.9573	0.9090	4.92
1,2,3,6,7,8-HxCDD	0.8314	0.9043	0.9052	0.9359	0.9359	0.9026	4.73
1,2,3,7,8,9-HxCDD	0.8565	0.8763	0.9003	0.9266	0.9153	0.8950	3.20
1,2,3,4,6,7,8-HpCDF	1.1049	1.1654	1.1997	1.2823	1.2449	1.1994	5.75
1,2,3,4,7,8,9-HpCDF	1.1387	1.1656	1.2257	1.2892	1.2353	1.2109	4.92
1,2,3,4,6,7,8-HpCDD	0.8917	0.9372	0.9719	1.0276	1.0178	0.9692	5.84
OCDF	0.9256	0.9767	0.9981	1.0986	1.0703	1.0139	6.94
OCDD	0.8835	0.9641	0.9292	0.9824	0.9725	0.9464	4.27
Total PeCDF	0.8494	0.8869	0.9657	0.9955	1.0012	0.9397	7.24
Total HxCDF	1.0134	1.0775	1.1381	1.1775	1.1718	1.1157	6.24
Total HxCDD	0.8478	0.8831	0.9096	0.9343	0.9362	0.9022	4.13
Total HpCDF	1.1218	1.1655	1.2127	1.2857	1.2401	1.2052	5.30
2,3,7,8-TCDF-13C	1.2774	1.2742	1.2612	1.2461	1.2611	1.2640	0.98
2,3,7,8-TCDD-13C	1.0321	1.0459	1.0771	1.0111	1.0470	1.0426	2.31
2,3,7,8-TCDD-37Cl4	0.8169	0.9323	0.9533	0.9783	1.0309	0.9424	8.40
1,2,3,7,8-PeCDF-13C	1.0537	1.0775	1.0227	1.0200	1.0592	1.0466	2.36
2,3,4,7,8-PeCDF-13C	1.0512	1.0726	1.0678	1.0115	1.0827	1.0571	2.65
1,2,3,7,8-PeCDD-13C	0.7608	0.7921	0.7924	0.7409	0.7983	0.7769	3.21
1,2,3,4,7,8-HxCDF-13C	1.1556	1.0886	0.9809	1.1450	1.1002	1.0941	6.34
1,2,3,6,7,8-HxCDF-13C	1.2681	1.2256	1.0928	1.2756	1.2214	1.2167	6.03
2,3,4,6,7,8-HxCDF-13C	1.1349	1.0734	0.9911	1.1211	1.0874	1.0816	5.21
1,2,3,7,8,9-HxCDF-13C	1.0058	0.9854	0.8807	0.9933	0.9866	0.9704	5.23
1,2,3,4,7,8-HxCDD-13C	1.0164	0.9810	0.8696	1.0258	1.0080	0.9802	6.53
1,2,3,6,7,8-HxCDD-13C	1.1202	1.1043	1.0208	1.1355	1.1310	1.1024	4.28
1,2,3,4,6,7,8-HpCDF-13C	1.2491	1.2217	1.0875	1.2280	1.2341	1.2041	5.48
1,2,3,4,7,8,9-HpCDF-13C	0.9880	1.0006	0.8771	0.9634	1.0185	0.9695	5.71
1,2,3,4,6,7,8-HpCDD-13C	1.0980	1.0766	0.9822	1.0556	1.0983	1.0621	4.53
OCDD-13C	0.9188	0.9233	0.8338	0.9071	0.9535	0.9073	4.91

REPORT OF LABORATORY ANALYSIS

Method 1613B
Initial Calibration (ICAL) - Isotope Ratio Summary

ICAL ID	**F190508**	Data Files:		Time	Injected
Calibration Date	05/08/2019	CS-1	F190508A_04	11:43	SMT
Instrument	10MSHR05 (F)	CS-2	F190508A_03	11:02	SMT
Column Phase	ZB5-MS 0.25mm	CS-3	F190508A_02	10:00	SMT
Column ID No.	ZB5-MS-629919	CS-4	F190508A_06	13:46	SMT
		CS-5	F190508A_05	13:05	SMT

Isomer	CS-1	CS-2	CS-3	CS-4	CS-5	Limits
2,3,7,8-TCDF	0.76	0.79	0.75	0.76	0.78	0.65 - 0.89
2,3,7,8-TCDD	0.79	0.75	0.82	0.76	0.78	0.65 - 0.89
1,2,3,7,8-PeCDF	1.54	1.53	1.61	1.54	1.58	1.32 - 1.78
2,3,4,7,8-PeCDF	1.53	1.60	1.54	1.55	1.54	1.32 - 1.78
1,2,3,7,8-PeCDD	0.55	0.62	0.61	0.61	0.62	0.52 - 0.70
1,2,3,4,7,8-HxCDF	1.30	1.29	1.28	1.26	1.24	1.05 - 1.43
1,2,3,6,7,8-HxCDF	1.22	1.30	1.21	1.26	1.24	1.05 - 1.43
2,3,4,6,7,8-HxCDF	1.27	1.19	1.22	1.24	1.23	1.05 - 1.43
1,2,3,7,8,9-HxCDF	1.43	1.23	1.26	1.21	1.23	1.05 - 1.43
1,2,3,4,7,8-HxCDD	1.26	1.33	1.23	1.24	1.24	1.05 - 1.43
1,2,3,6,7,8-HxCDD	1.23	1.25	1.21	1.22	1.22	1.05 - 1.43
1,2,3,7,8,9-HxCDD	1.25	1.26	1.21	1.22	1.19	1.05 - 1.43
1,2,3,4,6,7,8-HpCDF	1.05	1.00	1.01	1.02	1.03	0.88 - 1.20
1,2,3,4,7,8,9-HpCDF	0.94	1.06	1.03	1.03	1.03	0.88 - 1.20
1,2,3,4,6,7,8-HpCDD	0.95	1.04	1.00	1.00	1.04	0.88 - 1.20
OCDF	0.94	0.93	0.91	0.90	0.92	0.76 - 1.02
OCDD	0.86	0.86	0.88	0.89	0.88	0.76 - 1.02
1,2,3,4-TCDD-13C	0.79	0.79	0.79	0.78	0.78	0.65 - 0.89
1,2,3,7,8,9-HxCDD-13C	1.25	1.24	1.25	1.24	1.21	1.05 - 1.43
2,3,7,8-TCDF-13C	0.76	0.77	0.78	0.75	0.77	0.65 - 0.89
2,3,7,8-TCDD-13C	0.77	0.78	0.78	0.77	0.77	0.65 - 0.89
1,2,3,7,8-PeCDF-13C	1.61	1.56	1.57	1.56	1.57	1.32 - 1.78
2,3,4,7,8-PeCDF-13C	1.54	1.57	1.58	1.56	1.57	1.32 - 1.78
1,2,3,7,8-PeCDD-13C	1.56	1.58	1.56	1.58	1.54	1.32 - 1.78
1,2,3,4,7,8-HxCDF-13C	0.52	0.51	0.51	0.52	0.52	0.43 - 0.59
1,2,3,6,7,8-HxCDF-13C	0.54	0.51	0.50	0.53	0.52	0.43 - 0.59
2,3,4,6,7,8-HxCDF-13C	0.52	0.51	0.53	0.53	0.53	0.43 - 0.59
1,2,3,7,8,9-HxCDF-13C	0.51	0.53	0.53	0.54	0.52	0.43 - 0.59
1,2,3,4,7,8-HxCDD-13C	1.24	1.26	1.25	1.26	1.24	1.05 - 1.43
1,2,3,6,7,8-HxCDD-13C	1.26	1.25	1.25	1.26	1.23	1.05 - 1.43
1,2,3,4,6,7,8-HpCDF-13C	0.45	0.43	0.44	0.45	0.44	0.37 - 0.51
1,2,3,4,7,8,9-HpCDF-13C	0.45	0.44	0.45	0.45	0.44	0.37 - 0.51
1,2,3,4,6,7,8-HpCDD-13C	1.01	1.03	1.03	1.03	1.06	0.88 - 1.20
OCDD-13C	0.89	0.91	0.88	0.91	0.90	0.76 - 1.02

REPORT OF LABORATORY ANALYSIS

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Method 1613B Analysis Results
PCDD/PCDF Calibration Verification
Labeled Analytes

Lab Name	CS3/CPM-11321-150		
Filename	F190508B_19	Instrument ID	10MSHR05 (F)
Injected By	SMT	GC Column ID	ZB5-MS-629919
Analyzed	05/09/2019 04:26	ICAL ID	F190508

Native Isomers	m/z's Forming Ratio (1)	Ion Abund. Ratio	QC Limits (2)	Conc Found	Conc. Range (ng/ml) (3)
Labeled Compounds					
1,2,3,4-TCDD-13C	M/M+2	0.78	0.65 - 0.89	-----	-----
2,3,7,8-TCDD-13C	M/M+2	0.79	0.65 - 0.89	102.3	82 - 121
1,2,3,7,8-PeCDD-13C	M+2/M+4	1.55	1.32 - 1.78	100.1	62 - 160
1,2,3,4,7,8-HxCDD-13C	M+2/M+4	1.25	1.05 - 1.43	91.4	85 - 117
1,2,3,6,7,8-HxCDD-13C	M+2/M+4	1.25	1.05 - 1.43	93.2	85 - 118
1,2,3,7,8,9-HxCDD-13C	M+2/M+4	1.23	1.05 - 1.43	-----	-----
1,2,3,4,6,7,8-HpCDD-13C	M+2/M+4	1.05	0.88 - 1.20	94.8	72 - 138
OCDD-13C	M+2/M+4	0.90	0.76 - 1.02	178.9	96 - 415
2,3,7,8-TCDF-13C	M/M+2	0.76	0.65 - 0.89	99.6	71 - 140
1,2,3,7,8-PeCDF-13C	M+2/M+4	1.58	1.32 - 1.78	94.8	76 - 130
2,3,4,7,8-PeCDF-13C	M+2/M+4	1.56	1.32 - 1.78	99.1	77 - 130
1,2,3,4,7,8-HxCDF-13C	M/M+2	0.52	0.43 - 0.59	92.2	76 - 131
1,2,3,6,7,8-HxCDF-13C	M/M+2	0.52	0.43 - 0.59	90.0	70 - 143
2,3,4,6,7,8-HxCDF-13C	M/M+2	0.51	0.43 - 0.59	90.5	73 - 137
1,2,3,7,8,9-HxCDF-13C	M/M+2	0.51	0.43 - 0.59	90.9	74 - 135
1,2,3,4,6,7,8-HpCDF-13C	M/M+2	0.46	0.37 - 0.51	92.1	78 - 129
1,2,3,4,7,8,9-HpCDF-13C	M/M+2	0.45	0.37 - 0.51	91.2	77 - 129
Cleanup Standard					
2,3,7,8-TCDD-37Cl4	M+2/M+4	(4)		10.4	7.9 - 12.7

1. See Table 8, Method 1613, for m/z specifications.

2. Ion Abundance Ratio Control Limits from Table 9, Method 1613.

3. Contract-required concentration range as specified in Table 6, Method 1613, under VER (10/94 Revision).

4. No ion abundance ratio; report concentration found.

REPORT OF LABORATORY ANALYSIS

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Method 1613B Analysis Results
PCDD/PCDF Calibration Verification
Native Analytes

Lab Name	CS3/CPM-11321-150		
Filename	F190508B_19	Instrument ID	10MSHR05 (F)
Injected By	SMT	GC Column ID	ZB5-MS-629919
Analyzed	05/09/2019 04:26	ICAL ID	F190508

Native Isomers	m/z's Forming Ratio (1)	Ion Abund. Ratio	QC Limits (2)	Conc Found	Conc. Range (ng/ml) (3)
2,3,7,8-TCDD	M/M+2	0.76	0.65 - 0.89	11.0	7.8 - 12.9
1,2,3,7,8-PeCDD	M+2/M+4	0.62	0.52 - 0.70	51.8	39 - 65
1,2,3,4,7,8-HxCDD	M+2/M+4	1.24	1.05 - 1.43	50.8	39 - 64
1,2,3,6,7,8-HxCDD	M+2/M+4	1.20	1.05 - 1.43	51.4	39 - 64
1,2,3,7,8,9-HxCDD	M+2/M+4	1.22	1.05 - 1.43	52.3	41 - 61
1,2,3,4,6,7,8-HpCDD	M+2/M+4	1.03	0.88 - 1.20	51.8	43 - 58
OCDD	M+2/M+4	0.92	0.76 - 1.02	101.0	79 - 126
2,3,7,8-TCDF	M/M+2	0.76	0.65 - 0.89	9.5	8.4 - 12.0
1,2,3,7,8-PeCDF	M+2/M+4	1.57	1.32 - 1.78	54.3	41 - 60
2,3,4,7,8-PeCDF	M+2/M+4	1.59	1.32 - 1.78	50.8	41 - 61
1,2,3,4,7,8-HxCDF	M+2/M+4	1.24	1.05 - 1.43	49.7	45 - 56
1,2,3,6,7,8-HxCDF	M+2/M+4	1.25	1.05 - 1.43	51.0	44 - 57
2,3,4,6,7,8-HxCDF	M+2/M+4	1.23	1.05 - 1.43	51.2	44 - 57
1,2,3,7,8,9-HxCDF	M+2/M+4	1.27	1.05 - 1.43	50.8	45 - 56
1,2,3,4,6,7,8-HpCDF	M+2/M+4	1.02	0.88 - 1.20	52.2	45 - 55
1,2,3,4,7,8,9-HpCDF	M+2/M+4	1.04	0.88 - 1.20	50.1	43 - 58
OCDF	M+2/M+4	0.90	0.76 - 1.02	99.4	63 - 159

1. See Table 8, Method 1613, for m/z specifications.

2. Ion Abundance Ratio Control Limits from Table 9, Method 1613.

3. Contract-required concentration range as specified in Table 6, Method 1613, under VER (10/94 Revision).

REPORT OF LABORATORY ANALYSIS

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Method 1613B Analysis Results
PCDD/PCDF Calibration Verification
Labeled Analytes

Lab Name	CS3/CPM-11321-150		
Filename	F190509A_16	Instrument ID	10MSHR05 (F)
Injected By	SMT	GC Column ID	ZB5-MS-629919
Analyzed	05/09/2019 15:40	ICAL ID	F190508

Native Isomers	m/z's Forming Ratio (1)	Ion Abund. Ratio	QC Limits (2)	Conc Found	Conc. Range (ng/ml) (3)
Labeled Compounds					
1,2,3,4-TCDD-13C	M/M+2	0.78	0.65 - 0.89	-----	-----
2,3,7,8-TCDD-13C	M/M+2	0.77	0.65 - 0.89	101.9	82 - 121
1,2,3,7,8-PeCDD-13C	M+2/M+4	1.55	1.32 - 1.78	107.5	62 - 160
1,2,3,4,7,8-HxCDD-13C	M+2/M+4	1.25	1.05 - 1.43	91.5	85 - 117
1,2,3,6,7,8-HxCDD-13C	M+2/M+4	1.23	1.05 - 1.43	93.2	85 - 118
1,2,3,7,8,9-HxCDD-13C	M+2/M+4	1.25	1.05 - 1.43	-----	-----
1,2,3,4,6,7,8-HpCDD-13C	M+2/M+4	1.06	0.88 - 1.20	87.1	72 - 138
OCDD-13C	M+2/M+4	0.89	0.76 - 1.02	152.5	96 - 415
2,3,7,8-TCDF-13C	M/M+2	0.76	0.65 - 0.89	99.3	71 - 140
1,2,3,7,8-PeCDF-13C	M+2/M+4	1.58	1.32 - 1.78	96.8	76 - 130
2,3,4,7,8-PeCDF-13C	M+2/M+4	1.57	1.32 - 1.78	104.4	77 - 130
1,2,3,4,7,8-HxCDF-13C	M/M+2	0.52	0.43 - 0.59	88.5	76 - 131
1,2,3,6,7,8-HxCDF-13C	M/M+2	0.52	0.43 - 0.59	89.6	70 - 143
2,3,4,6,7,8-HxCDF-13C	M/M+2	0.51	0.43 - 0.59	90.6	73 - 137
1,2,3,7,8,9-HxCDF-13C	M/M+2	0.52	0.43 - 0.59	87.6	74 - 135
1,2,3,4,6,7,8-HpCDF-13C	M/M+2	0.45	0.37 - 0.51	87.1	78 - 129
1,2,3,4,7,8,9-HpCDF-13C	M/M+2	0.46	0.37 - 0.51	81.2	77 - 129
Cleanup Standard					
2,3,7,8-TCDD-37Cl4	M+2/M+4	(4)		10.3	7.9 - 12.7

1. See Table 8, Method 1613, for m/z specifications.

2. Ion Abundance Ratio Control Limits from Table 9, Method 1613.

3. Contract-required concentration range as specified in Table 6, Method 1613, under VER (10/94 Revision).

4. No ion abundance ratio; report concentration found.

REPORT OF LABORATORY ANALYSIS

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Method 1613B Analysis Results
PCDD/PCDF Calibration Verification
Native Analytes

Lab Name	CS3/CPM-11321-150		
Filename	F190509A_16	Instrument ID	10MSHR05 (F)
Injected By	SMT	GC Column ID	ZB5-MS-629919
Analyzed	05/09/2019 15:40	ICAL ID	F190508

Native Isomers	m/z's Forming Ratio (1)	Ion Abund. Ratio	QC Limits (2)	Conc Found	Conc. Range (ng/ml) (3)
2,3,7,8-TCDD	M/M+2	0.76	0.65 - 0.89	11.2	7.8 - 12.9
1,2,3,7,8-PeCDD	M+2/M+4	0.59	0.52 - 0.70	49.4	39 - 65
1,2,3,4,7,8-HxCDD	M+2/M+4	1.24	1.05 - 1.43	49.3	39 - 64
1,2,3,6,7,8-HxCDD	M+2/M+4	1.24	1.05 - 1.43	49.6	39 - 64
1,2,3,7,8,9-HxCDD	M+2/M+4	1.25	1.05 - 1.43	50.2	41 - 61
1,2,3,4,6,7,8-HpCDD	M+2/M+4	1.04	0.88 - 1.20	49.7	43 - 58
OCDD	M+2/M+4	0.88	0.76 - 1.02	96.2	79 - 126
2,3,7,8-TCDF	M/M+2	0.76	0.65 - 0.89	9.4	8.4 - 12.0
1,2,3,7,8-PeCDF	M+2/M+4	1.64	1.32 - 1.78	53.1	41 - 60
2,3,4,7,8-PeCDF	M+2/M+4	1.58	1.32 - 1.78	49.8	41 - 61
1,2,3,4,7,8-HxCDF	M+2/M+4	1.23	1.05 - 1.43	51.4	45 - 56
1,2,3,6,7,8-HxCDF	M+2/M+4	1.26	1.05 - 1.43	51.6	44 - 57
2,3,4,6,7,8-HxCDF	M+2/M+4	1.27	1.05 - 1.43	50.3	44 - 57
1,2,3,7,8,9-HxCDF	M+2/M+4	1.27	1.05 - 1.43	51.8	45 - 56
1,2,3,4,6,7,8-HpCDF	M+2/M+4	1.06	0.88 - 1.20	49.5	45 - 55
1,2,3,4,7,8,9-HpCDF	M+2/M+4	1.02	0.88 - 1.20	51.4	43 - 58
OCDF	M+2/M+4	0.89	0.76 - 1.02	96.0	63 - 159

1. See Table 8, Method 1613, for m/z specifications.

2. Ion Abundance Ratio Control Limits from Table 9, Method 1613.

3. Contract-required concentration range as specified in Table 6, Method 1613, under VER (10/94 Revision).

REPORT OF LABORATORY ANALYSIS